



## Document Tracking Form

Capital Project No.: IGS03-02  
 Title: SAH Element Replacement  
 Prepared By: Bret Kent

IPSC Work Order # 03-96032-0  
 Date: May 25, 2005  
 Supervisor: Dean Wood  
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**Item 1 - Construction Drawings**

Drawing Number	Rev. No.	Comments	Tag (X)	Available in current, waiting closeout	Date Submitted for Closeout	Date Closed Out
None						

**Item 2 - Manufacturer's Drawings**

Drawing Number	Rev. No.	Comments	Available in current, waiting closeout	Date Submitted for Closeout	Date Closed Out
62.3401.05-90613	P	065357			8/9/04
62.3401.05-90614	0	10041587		3/7/06	3-9-06
62.3401.05-90615	A	10021477		3/7/06	3-9-06
62.3401.05-90616	0	098856			8/9/04
62.3401.05-90617	A	099297			8/9/04
62.3401.05-90618	0	099502			8/9/04
62.3401.05-90619	0	10031472			8/9/04
62.3401.05-90620	0	10031477			8/9/04
62.3401.05-90621	0	80030674			8/9/04
62.3401.05-90622	0	80030675			8/9/04

**Item 3 - Instruction Manuals**

Instruction Manual Number	Title	Vol.	Comments/ Instruction	Date Submitted for Closeout	Date Closed Out
9255.62.3401	Instruction Book for Steam Generator	V			
	Add the following documents to Section 17 of the above referenced manual				
	SAH Clearflow Modifications			3/7/06	
	Seal Setting Procedure			3/7/06	

Once close out package is approved, these changes will be routed to Repo for distribution to all Gray Books.

**Item 4 - System Descriptions**

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System Code	System Title/Page	Comments/ Instructions	Date Submitted for Closeout	Date Closed Out
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**Item 5 - DATATRAK Revisions**

Device Number	New/ Revised/ Deleted	Comments	Date Submitted for Closeout	Date Closed Out
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**Item 6 - I & C Database Revisions**

Devise Number	New/ Revised/ Deleted	Comments	Date Submitted for Closeout	Date Closed Out
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**Item 7 - Ladder Logic Revisions**

Devise Number	New/ Revised/ Network #	Comments	Date Submitted for Closeout	Date Closed Out
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**Item 8 - Relay Manual Updates**

Manual and Page #	Relay #	Comments	Date Submitted for Closeout	Date Closed Out
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**IP7\_022778**

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### Item 9 - Miscellaneous Documentation

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**SAH Clearflow Modifications**  
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During the Spring outages of 2004 (Unit 2) and 2005 (Unit 1) the Secondary Air Heaters were modified to incorporate the Ljungstrom Air Preheater Clearflow Rotor upgrades. This work included rotor modifications (to accommodate new style heat transfer baskets) and installation of new heat transfer baskets.

The major change to the SAH's was the replacement of 4 layers of heat transfer baskets:

- Hot End Layer #22 Ga. "DL" 36" Depth Low Alloy / Corrosion Resistant
- Hot Intermediate Layer #22 Ga. "DL" 16" Depth Low Alloy / Corrosion Resistant
- Cold End Layer #18 Ga. NF-6 13.5" Depth Low Alloy / Corrosion Resistant
- Cold Intermediate Layer #22 Ga. "DL" 9.5" Depth Low Alloy / Corrosion Resistant

With 2 layers:

- Hot End Layer #22 Ga. "DL7" 41" Depth Low Alloy / Corrosion Resistant
- Cold End Layer #20 Ga. "DL7" 41" Depth Low Alloy / Corrosion Resistant

The other changes were require to accommodate the much larger style baskets and to provide better seals around baskets. In addition, the outside doors were skip welded shut, as side removal is not possible with the 41" tall baskets.

The following drawings were provided new as part of these modifications and can be found in the electronic drawing database:

<u>VENDOR DWG</u>	<u>REV</u>	<u>APCO DWG</u>	<u>DESCRIPTION</u>
62.3401.05-90613	P	65357	GENERAL WELDING SPECIFICATIONS
62.3401.05-90614	0	10041587	HOT & COLD END FLOATING T-BAR INSTALLATION
62.3401.05-90615	A	10021477	TENSION RING
62.3401.05-90616	0	098856	REFERENCE TABLE
62.3401.05-90617	A	099297	EE-ZEE(TM) BYPASS SEAL FIELD ASS'Y
62.3401.05-90618	0	099502	LIFTING ARRANGEMENT
62.3401.05-90619	0	10031472	CLEARFLOW ROTOR MODIFICATIONS
62.3401.05-90620	0	10031477	HOT END SEAL CLEARANCE GAUGE ASS'Y
62.3401.05-90621	0	80030674	BASKET ARRANGEMENT
62.3401.05-90622	0	80030675	BASKET SEALING BAR ARRANGEMENT

Relevant drawing to this modification that were not altered:

<u>VENDOR DWG</u>	<u>REV</u>	<u>APCO DWG</u>	<u>DESCRIPTION</u>
62.3401.05-90049	A	78077	SEC AIR HEATER RADIAL SEALS ASSEMBLY #3
62.3401.05-90044	0	78075	SEC AIR HEATER AXIAL SEALS ASSEMBLY #1
62.3401.05-90034	A	935428	SECONDARY AIR HEATER ROTOR ASSEMBLY #1

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## 1.0 Overview

Because the SAH's at the IPP site have the following existing conditions/modifications a special seal setting procedure is required to obtain satisfactory sealing.

- Hot end sector plates distorted as a result of fly ash entrapment.
- The addition of the electrical controls to establish "Mandatory Retract Position" at  $\frac{1}{4}$ " above "Nominal Cold Position".
- Seal Leakage Control System is operated as a two position arrangement instead of the infinitely variable arrangement as originally supplied.

The first procedure will outline the steps required to replace and set hot end radial seals. The second procedure will outline the steps required to check and refine the relative hot end sector plate positions and verify how closely they are to being planar. Following these procedures will be a brief procedure for setting the cold end radial seals and axial seals.

### 1.1 Definitions:

- A) Mandatory Retract Position:  $\frac{1}{4}$ " above "Nominal Cold Position"
- B) Nominal Cold Position: "0" position on control panel: This is a bit arbitrary with the modifications that have been made to the Active Leakage Control System. With the control panel indicating "0", the sector plates should be in plane with each other and at an elevation of  $\frac{3}{8}$ " to  $\frac{1}{2}$ " above the high point of the hot end "T" bar.
- C) Finger Tabs: Either purchased from APCO or made on site, these are bolted to the rotor diaphragms and adjusted for use as reference for relative positions of the various sealing surfaces (i.e. sector plates and axial seal plates).
- D) Radial Seal Straight Edge: In this case a two piece length of aluminum channel used as a gage for setting hot and cold end radial seals. Note that the hot radial seals are set  $\frac{1}{8}$ " below the faces of the hot sector plates at inboard and outboard ends and with a greater gap at the point where the straight edge is spliced near the mid span. This forms a shallow "V". The same straight edge

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assembly is used at the cold end, but the seals are set in a straight line from inboard to outboard ends.

- E) Seal Setting Spacer: The recommendation is a 1/8" thick strap, 1" to 1-1/2" wide and cut long enough to grasp easily. One is held between each end of a given seal and the straight edge while setting the seals.

**1.2 General Recommendations**

- A) It is recommend that the air supply and valves used to operate the air motor during seal setting be located conveniently in the duct and wired in place close to the work station. A minimum of 1" rubber air hose should be used for this purpose along with two valves in series – one a ball valve for manipulating the rotor and the other a gate valve as a safety back up for the ball valve. This will prevent accidental rotor rotation should someone accidentally snag the handle of the ball valve while people are working. The valves should be in a position to enable the operator to clearly see the relationship between seals and straight edge and to make sure no workmen are jeopardized by rotation.
- B) Lift the electrical contact for the rotor stoppage alarm signal in the hot end sector plate drive control panels to permit manual operation of the sector plates. You can not run sector plates from the "Mandatory Retract" position unless this is done.

**NOTE:** Do not forget to re-attach rotor stoppage connections in the control panels once seal setting is completed.

- C) During the process of setting the rotor seals, it is preferred not to set seals directly in contact with the seal straight edge. There are two reasons for this. First, should the rotor coast past the straight edge position while setting seals, the rotor may be turned 360 degrees to set the seals without any interference between the set seals and the straight edge. The second reason is that a more consistent seal setting is achieved because the only pressure on the straight edge is from the seal being set. Any seals previously set along the same diaphragm will have a gap with the straight edge once the spacers are removed. The recommendation is a 1/8" thick strap, 1" to 1-1/2" wide and cut long enough to grasp easily. One

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is held between each end of a given seal and the straight edge while setting the seals.

## **2.0 Hot End Radial Seals**

### **2.1 Seal Setting Without Refining Sector Plate Position**

- A) Drive both sector plates down to the “Nominal Cold” or 0” position on the panel.
- B) Pre-mount the two piece “Radial Seal Straight Edge” above one of the radial seals, and lift it up far enough to clear all remaining seals when the rotor is rotated. Note that the straight edge mounting brackets are already in place inside both the air inlet or gas outlet ducts.
- C) Remove the radial seals from at least one rotor diaphragm and install finger tabs loosely in a position which will not interfere with the sector plates as the rotor is turned.. Finger tabs are to be installed on the leading face of the selected rotor diaphragm at the first or second outboard and inboard seal bolt holes as well as at the two seal mounting bolt holes adjacent the splice near the mid-span of the seal straight edge. In addition, a finger tab should be installed approximately three feet inboard of the outer finger tab location. This latter tab (second inner) is to check amount of deformity of the distorted hot end sector plate.

If working in the gas inlet duct, rotate the rotor until the diaphragm passes beneath the first sector plate and nearly across the face of the second sector plate, stopping just about 2” before emerging from beneath the second sector plate into the gas duct. Set the finger tabs to the face of the plate at this location. This sector plate will be the one which has not suffered distortion.

If the seal straight edge has been installed on the air outlet side, the diaphragm with the finger tabs will be stopped about 2” under the leading edge of the first sector plate in rotation, as this is the undistorted plate, and set to the face of the plate at this point.

**NOTE:** The preferred method for installing the finger tabs is in such a way that they extend upward at about a 45 degree angle. Then snug the bolts sufficiently to

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hold them in place, but not so tightly that the tabs will not rotate as a result of contact with the sector plate surfaces.

- D) Rotate the rotor enough so that the finger tabs have traversed across the faces of both sector plates. Scribe a line across the face of the finger tabs at the top of the diaphragm as a reference. Tighten the mounting bolts for the finger tabs, making certain the tabs do not move by referring to the scribed line. Accomplish a second rotation while watching the finger tabs traverse both sector plates. If you observe significant gaps at inboard and/or outboard end locations the sector plates, the positions will require refining. Absent that, return the diaphragm with the finger tabs to the seal straight edge position and prepare to set the straight edge.
- E) Lower the seal straight edge sections down so they are just in contact with the finger tabs. Tighten the mounting bolts for the straight edge at the ends and center location. Note at this point, the gap between second inner finger tab and the face of the straight edge. This is the amount of distortion of the damaged sector plate assuming the inner and outer tabs were in close contact with both sector plates during the traverse.
- F) Refer to the seal setting chart from in this O&M manual.
- G) Loosen the seal straight edge mounting bolts and lower the straight edge down to the new position in contact with the finger tabs at inner and outboard ends. Tighten.

NOTE: This should be the final elevation position of the straight edge at inboard and outboard ends, if the 1/8" spacers are used to set seals as recommended.

- H) Proceed to the seal straight edge center span splice location and repeat. Now referring to your seal setting chart, select a spacer equivalent to the depth of the specified (V) dimension at the center span, and tap the finger tabs down until the spacer will just fit between the straight edge and the tips of the finger tabs. Now lower the seal straight edge to the tops of the finger tabs and tighten in place.



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**NOTE:** The radial seal straight edge is now in its final position and sits 1/8" higher than the correct elevation of the tops of the hot radial seals. To set the seals at their correct elevation it is therefore necessary to employ a 1/8" spacer near each end of a given seal, between every seal as it is set and the face of the straight edge. To reiterate; this assures that should the rotor coast past the setting location, during rotor indexing, the rotor may be rotated around again to the straight edge without any contact between seals & the straight edge. It also assures a more consistent seal setting by eliminating any pressure against the straight edge from any seal except the one being set.

**2.2 Refining Elevation of Hot End Sector Plates**

Assume that while sweeping the hot end sector plates with the finger tabs, it is found that the sector plates are out of plane enough to require re-setting. This could be either a simple elevational change or correcting a tilt of the plate relative to rotation.

To assist in determining which procedure to follow, add another outer finger tab on the diaphragm following the procedure used to setup the first finger tabs. This is accomplished by rotating the first tab beneath the sector plate; taking a reading with feeler gages; rotating the following diaphragm to the same location and setting a finger tab to the same reference point with the same feeler gage reading. You now have two finger tabs in plane with each other and on opposite sides of the same plate. These are then used as reference points for the following procedures:

- A) Correction of elevation required; This simply requires the drive of offending sector plate be manually operated at the control panel in the required direction until the face of the plate is in plane with that of the opposite plate. The elevation indicator on the panel is then re-set to zero (nominal cold position). The maximum retract and maximum deformation indicators on the panel may also require re-setting. It may also be necessary to re-set the rotary limit switches at the Duff Norton jactuators.

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- B) Correcting a tilted condition; This requires that one of the Duff-Norton jactuators be un-coupled from the gear box. The remaining side is then manually driven at the control panel until it is planer with the uncoupled side. The jactuator is then re-coupled. The elevation may now be refined and the indicator re-set on the control panel to 0" as described above. The maximum retract and maximum deformation indicators in the panel and on the Duff Norton jactuators may also require re-setting.
- C) If the elevation of the inboard ends of the sector plates are out of plane there could be two reasons.
- i) One of the sector plates may not have followed the hot end spool back down. A check of the gap between the face of the sector plates and spool flange will disclose whether this is the case. To correct, it will be necessary to free up the sector plate static seals and re-set the hold down bracket within the ceramic wool packed seal at the inner end of the sector plate.
  - ii) If the hot end spool is tipped out of level it would be better to have an OEM service representative on site to correct.

### **3.0 Other Seals**

#### **3.1 Cold End Radial Seals**

The procedure for setting the cold end radial seals is relatively simple when compared to the hot radials as outlined above. This is due to the fact the seals are set to a clearance in the cold condition and subsequently make contact with the sealing surfaces only at operating temperatures. Also, the cold end sector plates are supported from the cold end structure and have no driving system. Therefore, once the sector plates have been set in-plane with each other they will normally require no further adjustment. The only scenarios this may not hold true:

- If there has been a fire or other problem which may have warped the supporting structure.
- If there was a bearing failure which resulted in severe wear to a given sector plate.

Working at the cold end of the preheater normally requires building a scaffold. The top of the scaffold platform should be roughly six feet below the cold end of the rotor to provide easy access to seal bolting and

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to keep interference between human parts and rotating members to a minimum.

To set the seal straight edge up for the cold end it is necessary to:

- A) Remove the radial seals from one diaphragm of the rotor and pre-hang the seal straight edge down below interference with any rotating member.
- B) Rotate the selected diaphragm to a point about 2" in from the leading edge and above the face of first sector plate.
- C) Set the finger tabs (inboard, outboard and center) against the face of the sector plate and tighten in position at about a 45 degree angle. Again it is preferred to tighten them only enough to hold in place.
- D) Observe the traverse of the finger tabs across the faces of both sector plates. If plates are within tolerance (within 1/16" of plane with each other), rotate the finger tabs to the straight edge location and continue with set up.
- E) Raise the seal straight edge and tighten in place, using the spacers you will use while setting seals as a spacer between finger tabs and straight edge. (Recommended spacer is 1/8" thick x 1" to 1-1/2" wide strap cut long enough to grasp easily.) Tighten the straight edge mounting bolts.
- F) Refer to the seal setting chart in this O&M Manual. Select spacers equivalent to the outboard seal gap and equivalent to one half of the outer dimension to be used for the center straight edge splice location. The inboard seal setting is 0" so the only positions requiring elevation adjustment are the two at center span and the outboard location.
- G) Loosen each of the three finger tabs in turn, insert the appropriate seal dimension spacer and re-tighten the finger tab bolts with the tabs at the raised position.
- H) Loosen the straight edge mounting bolts and raise the straight edge so it is in contact with the two center and the outer finger tabs.

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- I) The seals may now be set to the straight edge using your 1/8" thick spacers between each seal and the straight edge.

### **3.2 Axial Seals**

The procedure for setting axial seals is identical to that described above, for the cold end radials, except there is no center splice in the straight edge. The finger tabs are set tight to the face of an axial seal plate hot and cold ends. The heater is then rotated and discrepancies observed. If axial seal plates are concentric within or close to nominal tolerances, then the straight edge is set up tight to the finger tabs with your selected seal setting spacer between, and tightened into position. The finger tabs are then rotated (moved) away from the straight edge by a dimension equivalent to the seal setting dimensions from the chart in this O&M manual and tightened. The seal straight edge is then moved tight to the finger tabs and fastened in place. You are now ready to set axial seals using your seal setting spacers between the straight edge and the seals.

<b>Rev</b>	<b>Date</b>	<b>Description</b>	<b>Revision</b>	<b>Approval</b>
0	12/9/05	Original draft created by Harlan Finnemore (Field Service Engineer, APCO) clarifications added by Bret Kent (IPSC)	HEF	BK